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TITLE   PLANNING AN MIS FOR A JOB SHOP ENVIRONMENT

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INTRODUCTION

The Mechanical and Electronics Support Division (MEC Division) of the Los Alamos National Laboratory (LANL) is an organization of approximately five hundred people, over half of which are involved in the fabrication of a wide variety of items as prototypes or in small lot sizes. In addition to having a diversity of fabrication processes and equipment, the division has groups that are responsible for various support activities including inspection, calibration, and electronic equipment maintenance, and has several facilities that are located at widely spaced sites. These factors contribute to a fragmented organization that is difficult to manage with any precision.

Several years ago the decision was made to computerize the information needed for management of the division, and to centralize the resulting manufacturing information system (MIS) in one computer located at the main facility. The effort was contracted out to a software development company in July of 1981. After over five years, and in spite of tremendous investments of time and money in the existing system, the decision was made to phase out the existing system, start over, and try again to develop an information system that would meet the needs of the division.

In January 1987, a study was initiated to formulate a long-range plan, which would effectively guide and direct MEC Division's information system development. Recent significant additions to the organization, changes in management staffing, and concerns for the adequacy and appropriateness of the hardware and software of the division's current MIS, led to the decision to perform the study.

The study consisted of identifying the current and long-term information needs, consistent with the division's mission and goals, and recommending a plan to effectively implement information systems to fulfill these needs. Business Systems Planning (BSP), a methodology developed by IBM, was used in the study.

A HARD DECISION

Early after its implementation MEC's original MIS began to receive criticism from many quarters including system users, data entry personnel, and management. The criticism came both directly in the form of complaints and indirectly in the form of lack of cooperation in using the MIS or submitting data to it. The complaints included problems of slow response, difficulty of use, excessive and increasing paperwork, and inadequate or nonexistent data. The criticism was, for the most part, unexpected. There was considerable confidence in the software developer's competence, and careful planning had gone into the design of the system. Most MISs have been developed in a "bottom up" fashion. That is, they have evolved from several independent computer applications that have sprung up over time throughout an organization. MISs developed in this way are usually doomed to failure, or at least ineffectiveness, because they are only by-products of localized efforts at information system improvement. But in MEC's case, the system was designed "top down" (i.e. from the perspective of the information needs of the managers that would use it) and yet, it still proved to be disappointing and relatively ineffective in serving many of the division's needs.

On the other hand, there were some functions of the MIS that seemed to be furnishing exactly the right service, and a considerable investment had been made in the current system. Therefore, admitting that the system was ineffective and reaching the decision to consider the possibility of starting over was difficult. There were, however, other considerations that helped lead to the decision to seriously evaluate the need. Development of software seemed to be a continuous, resource devouring process. Updates to the system were expensive and apparently never ending, and yet the system never seemed to provide what was really needed, either by management or other users. Also, the computer that was used for the system was not one of the standard computers used at LANL. This resulted in compatibility problems with other Lab systems such as the accounting office and some of MEC's customer's systems.

These considerations led to the decision to make a complete evaluation of the division's information needs, and from the results of the evaluation, formulate a plan to fulfill those needs.

AN APPROACH TO A SOLUTION

MEC management realized that they did not have the computer and systems expertise to properly make an evaluation of the division's information needs, and began to search for a source of help. Contacts in LANL's Administrative Data Processing Division suggested that MEC consider using Business Systems Planning (BSP), a methodology developed by IBM. Other methods were available (e.g. Critical Success Factor Analysis), but the BSP methodology had been used with satisfactory results by other LANL divisions, and was particularly attractive because it provides a formal, objective method for management to evaluate information system needs and priorities, and is designed to produce recommendations for information systems that are relatively independent of organization structure or personalities. A five person study team was selected and received training in the theory and application of the methodology from IBM. Once the team was trained a formal BSP study was undertaken with the following stated objectives:

1. Define the information systems and related rocesses that currently exist in the operation of MEC division.

2. Define the data used and/or created in MEC division as it is currently operated.

3. Analyze the data needs, systems, and processes, and define existing problems.

4. Evaluate the organization's need to share data and hardware resources.

5. Help management understand the role of information within the organization.

6. Develop recommendations for solving the division's information related problems. These recommendations will include both short and long range considerations, and address hardware, software, and system needs.

UNDERSTANDING THE BUSINESS

The first step taken by the study team was to analyze the division's business as a whole to get a complete picture of the information structure of the organization. The team reviewed the existing long range plans, the current and future operating environment, and the products, services, and employees of the organization. The BSP methodology relies heavily on input, both written and obtained from interviews, from people who create and/or use the data of interest to the organization. Written input was obtained from pre-interview questionnaires that were sent to the leaders of each of the division's functional areas and to several other key personnel. Each was asked to submit an organization chart of their group or area of responsibility and a written response to the following questions:

1. Briefly describe your job and responsibilities.

2. What information, reports or forms do you currently use/receive, both from inside and outside the division?

3. How well does the information that you now receive meet your needs with respect to timeliness and accuracy (or other measures that you apply to judge the adequacy of the information)?

4. What is the impact on your resources (people/money) of continuing the present systems?

5. What features or functions would be most important to you in an ideal system?

6. What other information do you need that you do not now receive?

7. Do you receive reports which you do not need, and if so, what are they?

8. Do you supply information to other groups, divisions, etc., or to outside agencies?

9. What data do you maintain in your office?

10. What hardware do you have to support your information systems, and what are your plans for future hardware?

11. Relative to your responsibilities, what critical problems do you have with respect to information or reports that you currently receive or that you anticipate needing in the future?

12. Do you have other comments regarding information concerns that you would like to express that have not been covered?

13. What would you like to see result from this study?

The written responses to the questionnaire provided one of the primary sources of data that was analyzed by the team. From the information obtained two important elements were determined: the division's business processes, and the data classes.

Business processes are defined as groups of logically related decisions and activities required to manage the resources of a business. They are studied and identified without regard to the organization responsible for them. The reason for defining the processes is that doing so will provide or lead to:

o   Information systems that are largely independent of organizational changes.

o   An understanding of how the business accomplishes its overall missions and objectives.

o   A basis for defining required information architecture, determining its scope, making it modular, and setting priorities for its development.

o   A basis for defining key data requirements.[1]

The processes are not just identified, a definition of each is written. Defining the processes requires not only the realization that such a process exists, but also an understanding of what the process actually does. Twenty eight unique processes were identified and defined for MEC Division. The following three examples illustrate the sort of processes identified and their descriptions:

o   Process - Establish Business Direction

Definition - This process consists of all those decisions and activities associated with setting division goals, objectives, and strategy. This includes major decisions concerning organizational structure, and future directions of the business.

o   Process - Fabricate Manufactured Parts/Hardware

Definition - Activities for actual production of manufactured parts or electronic hardware, includes inspection.

o   Process - Schedule and Track Fabrication

Definition - Activities to schedule and monitor the workload, status, and priorities of jobs in work centers. Also the scheduling and tracking of fabrication outside the division by vendor liaison personnel.

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[1]Business Systems Planning, Information Systems Planning Guide. International Business Machines Corp., Atlanta, Georgia, GE20-0527-4, 1984, pg. 29.

A data class is a logical grouping of data related to things that are significant to the organization. They are identified in order to:

o   Determine data sharing requirements across processes.

o   Determine data that is necessary but either unavailable or insufficient for business use.

o   Establish the groundwork for data policy formulation (including data integrity responsibility).[2]

In the process of analyzing the business data the "things that are significant to the organization" are referred to as entities. The entities are first identified and defined, and then the business data that is logically grouped about these entities is identified and defined. Twenty three entities and fifty four data classes were identified and defined for MEC division. The following is an example of one entity that had four related data classes:

Entity: Accounts
Definition: Detailed accounting information supplied by the accounting
               group concerning charges against an account number.

Data Class: Account Description
Definition: The program code and cost center code that identifies a
               financial record.

Data Class: Account Status
Description: Data on the current account balances and transactions
               updating general ledger accounts.

Data Class: Accounts Payable
Description: Data pertaining to the financial status with vendors and
               other Laboratory organizations.

Data Class: Accounts Receivable
Description: Data pertaining to the financial status of customers.

As was the case with defining the business processes, defining the data classes requires not only an awareness of the existence of something, but also an understanding. Having gone through the tedious process of identifying and defining all of the significant processes and data classes involved in the operation of the division's business, the study team was now far better prepared to proceed with the task of determining the information needs of the division.

TOOLS FOR ANALYSIS

The BSP methodology utilizes matrices extensively as aids to analysis. To relate the business processes to the division's organization a process/organization matrix was developed. This matrix illustrates who has involvement, and

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[2] loc. cit., pg. 36.

who makes decisions in each of the processes. MEC's process/organization matrix is shown in Figure 1. As the legend indicates, the different symbols show the level of involvement that each part of the organization has in each process. No symbol indicates no involvement. This matrix was validated by the individuals that were interviewed. Each person interviewed was asked to confirm or correct the portion of the matrix showing his responsibility or involvement. As a result of preparing this matrix the team had a much better understanding of the organization and how it was managed and controlled.

The tool used to analyze the relationship between the business processes and the business data was the process/data class matrix. The process/data class matrix developed for MEC Division is shown in Figure 2. The C's on the matrix show which processes create the data and the U's show which processes use the data. The matrix serves several purposes. It helps to analyze data problems such as data being created but not used, or data being created in more than one process. It also helps to identify dependencies between processes. The data flow in the organization is also clearly presented by the matrix, providing significant assistance in determining a strategy for defining the information architecture needed in the organization. In fact, by slightly rearranging the matrix a flow diagram can be developed as is shown in Figure 3. In this figure the processes and data classes have been regrouped resulting in a depiction of the flow of data from one logical part of the organization to another. This does not necessarily reflect the actual physical organization structure, either as it is or as it should be, but rather the data flow needed between broad groupings of processes.

ASSESSING CURRENT SYSTEM SUPPORT

The efforts to this point gave the team an understanding of the business processes and the data needs throughout the division, but gave no clear indication of the adequacy of the existing information system. A process/organization/system matrix was developed which is simply the process/organization matrix with numbers replacing the involvement indicators. The numbers represent the various existing information systems that were reported to exist throughout the division including those resident as part of the MIS, and others that existed independent of the MIS. This matrix enabled the team to identify processes receiving no current systems support, or receiving support in some organizational units, but not all; and to identify redundant systems. This matrix also helped to determine how much data was shared by the various systems. As with the process/organization matrix, this matrix was validated by the individuals that were interviewed.

INTERVIEWS WITH KEY PERSONNEL

The formal interviews were the most time consuming, but also probably the most valuable single process of the BSP study. The recommendation given in BSP training is for two to four hour interviews with 20 to 30 executives from the top levels of management. MEC's organizational levels are Division, Group, Section, and Shop. The team chose to interview the Division Leader, all of the Group Leaders, several Section Leaders, and a few selected Shop Foremen. In addition a few individuals in non management positions were interviewed because they were considered to have unique information needs (e.g. the property and facilities coordinators). This was somewhat of a deviation from the recommended procedure, but it was felt to be justified since much of the perceived problems with the existing MIS were being experienced at the lower management

levels. A total of thirty interviews were conducted. About half were four hours, and the remainder two hours each. The entire team participated in each of the interviews, each r.ember having a specific assignment; either participation in the verbal exchar.je, or taking notes. After each interview the team summarized the interview in writing and gave the interviewee the opportunity to revise any portion of the summary to clarify his opinions, needs, etc.

In the interviews the analysis that was done on all of the data that had been previously gathered was verified. The questions asked of the interviewees were essentially the same as were used to solicit written input. Each person interviewed was given the opportunity to confirm or correct the portions of the various matrices that related to his responsibility or involvement in the operations of the organization. In addition, the interviews gave the team an opportunity to clear up any areas of confusion regarding the data needs or information flow throughout the division. The interviews also gave the opportunity to identify and investigate information problems and opportunities and to discuss potential solutions and values.

FINDINGS OF THE STUDY

All of the information related problems identified during the analysis portion of the study and the interview summaries were organized into groups under seven rather broad categories. General conclusions and recommendations related to each of the categories were then drawn from the information (especially the interviews).

Since the texts of the interview summaries are not presented in this paper, it may not be clear why some of the conclusions were reached. They are presented in order to show the types of things that the study revealed.

CATEGORY 1: FABRICATION/CUSTOMER SERVICE

Conclusions

o   Timely information for scheduling and tracking of fabrication/service requests was the major problem in this category. This lack of information was attributed to untimely and inaccurate reports, personnel unwilling to provide timely information from the shop floor, data entry not being done in a timely manner, and lack of knowledge as to what information was available from MIS.

o   Some of the other general concerns were that job estimating was not standardized, and process planning was not being done on critical parts.

o   The fact that the division did not have a system to get feedback from customers on the quality of fabrication and services provided was also revealed.

Recommendations

o   Develop an information system that allows the shop supervisor to schedule and track work within his shop, and track jobs that are his responsibility while they are in other shops. The system should also allow the supervisor to keep job process and job histories, as well as take care of the accounting requirements.

o   Develop a system that has easy input of information at all levels, and educate employees in its use and the importance of the data input.

o   Job order processing, data entry procedures, and types of reports generated need to be reviewed and revised to meet the needs of the customers and division.

o   Develop procedures for identifying jobs that should be process planned, develop standards for process planning, job estimates, and changes to job orders.

o   Customer feedback regarding parts produced or service performed should be treated as data and included in history files on the system.

CATEGORY 2: FACILITIES/EQUIPMENT

Conclusions

The information related problems identified in the Facilities/Equipment category were:

o   There is a lack of information flow on equipment delivery, facilities and equipment plans, facilities and equipment requirements, project status for facility, maintenance and modification, and usage.

o   Tracking of property numbered items is difficult with the present system.

Recommendations

o   Develop an information system to aide in facilities and equipment management, including information on facilities and equipment requirements, planned acquisitions, dispositions of equipment, and equipment usage.

o   Develop a better Lab-wide information system to help report the location of property numbered items.

o   Equipment acquisition and facilities project status information should be made available on the information system.

CATEGORY 3: FINANCE/FUNDING

Conclusions

The conclusions identified in the category Finance/Funding were:

o   Financial reports are difficult to understand, untimely, and contain inaccurate data.

o   Difficult to get concise financial picture for the division because of the many information systems and recharge technique used within the Division.

Recommendations

o   Design data input methods in the information system that are quick and easy to use.

o   Make data available via electronic media to as many users as possible.

o   Train users in the proper use and interpretation of the system and data.

o   If two recharge techniques must be used in the Division, then the two resulting accounting systems should be made as similar as possible, from the standpoint of input and reporting, to minimize confusion.

CATEGORY 4: INFORMATION SYSTEM

Conclusions

o   Most of the problems noted in this category are traceable to the process of establishing the information system requirements. There are significant problems or inadequacies in the current MIS system. It is slow, cumbersome to use, and the hardware is not compatible with other systems at the Lab.

o   The reports generated by the system are, in general, perceived as untimely, however, there are differing opinions as to the definition of timeliness.

o   Because the present system is hard to use, it is not used as widely as it should be. There is not good cooperation in entering data into the system, and many potential users are unaware of the system's capabilities.

o   Major obstacles to system development include a lack of coordination of computer related activities within the division, and a lack of a formal administrative security technique.

Recommendations

o   Create an information system organization with Division-wide responsibility to coordinate all computer information needs.

o   Change to standard computer hardware to assure Lab-wide compatibility.

o   Develop an information system that allows users to view reports via electronic media rather than paper, and with information and format of their choice. Make ease of use a system priority.

CATEGORY 5: MATERIAL MANAGEMENT

Conclusion

Material management did not have many identified problems; therefore, from a division perspective, this is not a critical category.

o   Computerized inventory systems are needed in several shops.

o   Purchase requests should have information identifying the area to which items will be assigned.

o   The current metal stock inventory system only indicates size and total quantity of stock available. Length of individual pieces is not indicated.

Recommendations

o   Develop an inventory system for the glass shop and electronic service section.

o   Make INFORM available to supervisors so they can access stores information.

o   Modify the metal stock inventory system to indicate size and length of each individual piece.

CATEGORY 6: ORGANIZATION MANAGEMENT

Two basic groups of problems were defined within Organization Management. "Policies and Procedures" had several main points, as did "Establish Business Direction." In terms of information, these problems were related to a need for adequate planning, and communication of individual and organizational responsibilities involved in accomplishing the resulting plans. Aside from providing management with data to use in making plans, a computerized information system would contribute little to solving the problems in these two areas.

CATEGORY 7: PERSONNEL MANAGEMENT

Conclusions

Most of the problems noted in the category Personnel Management were related to staffing and communications.

o   A need was revealed for better determination of personnel requirements, and better selection procedures for hiring personnel to meet the requirements.

o   Training needs was a related problem area that was mentioned frequently, as was the need for better dissemination of information throughout the division, particularly to lower levels of the organization.

Recommendations

o   Develop an information system to assist MEC Division with staffing problems by providing a skills inventory, performance appraisal documentation file, and work history file for management use.

o   A wider distribution list is needed for general information (progress, trip and engineering reports, and staff meeting minutes).

SOFTWARE RECOMMENDATIONS

To facilitate implementation as early as practicable, the BSP Team analyzed and prioritized the application software to be implemented first. Prioritizing of the business processes was based on a value analysis of the problem statements obtained from the interviews. The problem statements were sorted and grouped into seven categories by the business process causing the information deficiency. The business processes were then ranked using a set of criteria to determine the worth to the division of solving the non data related problems and/or developing an application software package to support the data related processes.

Five selection criteria were used in evaluating each business process:

1. The near and/or long-term potential benefit to the Division that would be derived from a management solution or if an information system supporting a particular process were developed.

2. The impact on the Division that a management solution or an application package would have concerning number of problems addressed and major problems solved.

3. The probability of successful implementation of management policy or an application software package keeping in mind the resources available and length of implementation.

4. The demand for the support of each business process.

5. The interviewees' personal evaluation of the solution value for the particular business process.

Following prioritization, the business processes were grouped logically into six packages, which should be implemented as individual development projects. The following is a list of the prioritized application packages:

1. Planning

   The Planning package has no software to be developed, but personnel could utilize a standard MEC Division word processing package. The following processes are grouped in this package:

   A. Establish Information System Requirements
   B. Establish Business Direction
   C. Determine Equipment Requirement
   D. Determine, Forecast, and Control Financial Requirements
   E. Determine and Forecast Customer Requirements
   F. Determine Facilities and Real Estate Requirements

2. Fabrication Work Order Processing

   Fabrication Work Order Processing is essentially a shop floor system which tracks status and priorities, does estimating, routing, scheduling, and maintains job history. The following processes are grouped in this package:

A. Schedule and Track Fabrication
B. Fabricate Manufactured Parts/Hardware
C. Track Product (and Service) Performance
D. Process Customer Order
E. Develop Process
F. Process Purchase Requests

3. Human Resource Management

The Human Resource Management package consists of employee docu-
mentation, payroll attendance, training, and safety records. The
following processes are grouped in this package:

A. Comply with Policies and Procedures
B. Determine Personnel Requirements
C. Manage Personnel
D. Coordinate Security
E. Administer Contract Personnel

4. Property Management

The Property Management package consists of a parts and material
inventory control system, purchase request detail tracking, capital
equipment status and scheduling, machine tool scheduling, status, and
utilization. The following processes are grouped in this package:

A. Manage Computer Systems
B. Manage Equipment
C. Manage Raw Material and Inventory
D. Manage and Modify Facilities
E. Acquire and Dispose Capital Equipment
F. Acquire and Dispose Facilities
G. Acquire and Dispose Raw Materials and Inventory

5. Customer Service Work Order Processing

The Customer Service Work Order Processing package consists of field
service history, status, effort, and feedback information. The
following processes are grouped in this package:

A. Track (Product) and Service Performance
B. Process Customer Order
C. Provide Customer Service
D. Schedule and Track Customer Service
E. Process Purchase Requests
F. Sell, Ship, and Deliver Inventory

6. Financial/Accounting

The Financial/Accounting package will include a cost forecast system,
and a means to condense budget and accounting information. There was
only one process in this package:

A. Manage Budgets and Accounts

FUTURE IMPLEMENTATION

With the prioritized application architecture and all of the recommenda-
tions of the BSP study in hand, it will now be possible for MEC Division man·
agement to proceed with implementation of an MIS that has a very good chance of
meeting the real information needs of the division. It was not within the
scope of the team's effort to recommend a specific replacement for the com-
puter, but because a VAX 11/750 is available (which is a Lab standard computer)
it will probably be used. The recommendation for this and other details have
been left for an implementation team which will add to the effort of the BSP
team by addressing specific system definition and establishing priorities at a
lower level than those established by the BSP team. This definition phase is
expected to take from three to six months because of the lack of available
staffing for a full-time effort. Actual implementation will start immediately
after the definition phase, and is expected to take about two years for comple-
tion. The BSP team has been appointed as a steering committee to oversee the
implementation, and to assure that the intent of the recommendations of the
study is not lost during the implementation process.

From the experience gained from the existing MIS, it is evident that system
definition is not all that's needed to assure success. I recently read a state-
ment that was referring to computer aided manufacturing in general, but fits
perfectly the situation that MEC Division has experienced in finding it neces-
sary to plan for a new MIS.

"Very little is being done to understand what is going through the mind of
the guy working on the factory floor." Workers may claim to welcome a new
system, but if in fact they feel threatened, productivity will be affected.
"The worker is the one who has to accept the system. If he's not entering
the correct data, if he wasn't motivated enough to really learn how to
operate the system, then it won't work."[3]

Other considerations such as the nonstandard computer contributed to the
need to start over, but the overwhelming reason was the lack of acceptance of
the system by those that had to use it. MEC's new MIS, which was defined by
the BSP study team, must now be implemented. To help assure acceptance, a
"bottom-up" approach will be used, starting with high priority items on the
application architecture list, but tailoring the applications first of all to
the needs and preferences of the first line users.

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[3]Ann Bischoff, manager of industry planning at Prime Computer, as quoted
in Mechanical Engineering, October, 1987, pg. 75.

PROCESS/ORGANIZATION MATRIX FOR MEC DIVISION

PROCESS (column headings)

1. ESTABLISH/DISTRIBUTE AUTHORIZATION
2. COMPLY WITH POLICIES AND PROCEDURES
3. DETERMINE AND FORECAST CUSTOMER REQUIREMENTS
4. DETERMINE FORECAST AND CONTROL FINANCIAL REQUIREMENTS
5. DETERMINE FACILITIES AND EQUIPMENT REQUIREMENTS
6. DETERMINE PERSONNEL REQUIREMENTS
7. ESTABLISH INFORMATION SYSTEM REQUIREMENT
8. PROCESS CUSTOMER ORDER
9. DEVELOP PROCESS
10. SCHEDULE AND TRACK FABRICATION
11. FABRICATE MANUFACTURED PARTS/HARDWARE
12. PROVIDE CUSTOMER SERVICE
13. SCHEDULE AND TRACK CUSTOMER SERVICE
14. TRACK PRODUCT AND SERVICE PERFORMANCE
15. MANAGE BUDGET AND ACCOUNTS
16. PROCESS PURCHASE REQUESTS
17. ACQUIRE AND DISPOSE RAW MATERIALS AND INVENTORY
18. MANAGE RAW MATERIALS AND INVENTORY
19. SELL SHIP AND DELIVER INVENTORY
20. ACQUIRE AND DISPOSE FACILITIES
21. MANAGE AND MODIFY FACILITIES
22. COORDINATE SECURITY
23. DETERMINE EQUIPMENT REQUIREMENTS
24. ACQUIRE AND DISPOSE CAPITAL EQUIPMENT
25. MANAGE EQUIPMENT
26. MANAGE COMPUTER SYSTEMS
27. ADMINISTER CONTRACT PERSONNEL
28. MANAGE PERSONNEL

ORGANIZATION (row headings)

- DIVISION LEADER
- ASSISTANT DIVISION LEADER FOR ADMINISTRATION
- ASSOCIATE DIVISION LEADER SPECIAL PROJECTS
- CENTRAL FABRICATION - MEC-1
- DESIGN AND CONTRACT SERVICE - MEC-2
- FACILITIES AND EQUIPMENT SERVICE - MEC-3
- INSPECTION - MEC-4
- SITE FABRICATION - MEC-5
- FABRICATION DEVELOPMENT - MEC-6
- FABRICATION SUPPORT - MEC-7
- STANDARDS AND CALIBRATION - MEC-8
- ELECTRONIC AND VACUUM MAINTENANCE - MEC-9
- SPECIALIZED FABRICATION - MEC-10
- FACILITY MANAGER
- PROPERTY MANAGER
- MATERIALS CONTROLLER
- CAPTAIN/SUPERVISOR
- PROCUREMENT AND TOOLING SUPPORT
- SAFETY PROJECT LEADER
- EQUIPMENT ACQUISITION COORDINATOR
- SUPERVISORS

Legend:

- ☒ Major Responsibility and Decision Maker
- ⊠ Major Involvement in Process
- ◪ Some Involvement in Process

PROCESS \ DATA CLASS	BUSINESS PLAN	ORGANIZATION/ALTERNAT UNIT DESCRIPTION	POLICIES AND PROCEDURES	CUSTOMER REQUIREMENT	SALES REQUIREMENTS	ACCOUNT DESCRIPTION	FINANCIAL PLAN	OPERATING PLAN	FACILITY REQUIREMENTS	FACILITY PLAN	EMPLOYEE REQUIREMENTS	JOB	PERSONNEL PLAN	INFORMATION SYSTEM PLAN	INVENTORY REQUIREMENTS	FABRICATED PART DESCRIPTION	CUSTOMER ORDER REQUIREMENTS	CUSTOMER DESCRIPTION	CUSTOMER ORDER	FABRICATED PARTS REQUIREMENT	PURCHASE REQUIREMENTS	CUSTOMER SERVICE REQUIREMENTS	PROCESS PLAN	PRODUCTION SCHEDULE	FABRICATED PART STATUS	CUSTOMER SERVICE STATUS	CUSTOMER SERVICE DESCRIPTION	MAINTENANCE SCHEDULE	FEEDBACK	ACCOUNT STATUS	BUDGET STATUS	ACCOUNTS RECEIVABLE	ACCOUNTS PAYABLE	PURCHASE REQUEST DESCRIPTION	VENDOR SERVICE DESCRIPTION	VENDOR DESCRIPTION	PURCHASE STATUS	INVENTORY DESCRIPTION	RAW MATERIAL DESCRIPTION	INVENTORY STATUS	RAW MATERIAL STATUS	DELIVERY STATUS	FACILITY DESCRIPTION	FACILITY STATUS	EQUIPMENT REQUIREMENTS	EQUIPMENT PLAN	EQUIPMENT DESCRIPTION	EQUIPMENT STATUS	COMPUTER SYSTEMS STATUS	CONTRACT PERSONNEL DESCRIPTION	CONTRACT ATTENDANCE RECORDS	EMPLOYEE DESCRIPTION	EMPLOYEE STATUS	EMPLOYEE ATTENDANCE RECORDS
ESTABLISH BUSINESS DIRECTION	C	C	U	U																									U																									
COMPLY WITH POLICIES AND PROCEDURES		C																																																				
DETERMINE AND FORECAST CUSTOMER REQUIREMENTS	U		C											U																																								
DETERMINE FORECAST AND CONTROL FINANCIAL REQUIREMENTS	U	U			C	C	C	C		U			U	U	U															U	U												U			U		U		U				U
DETERMINE FACILITIES AND REAL ESTATE REQUIREMENTS	U	U		U	U	U			C	C			U	U																													U	U	U	U	U						U	
DETERMINE PERSONNEL REQUIREMENTS	U	U				U					U	C	C	C																															U	U					U	U	
ESTABLISH INFORMATION SYSTEM REQUIREMENT	U	U	U				U			U			U	C																															U	U							
PROCESS CUSTOMER ORDER			U											U	C	C	C	C	C	C	C	C	U									U								U							U						
DEVELOP PROCESS		U								U				U	U	U	U	U		U		C																							U						U		
SCHEDULE AND TRACK FABRICATION	U									U			U	U	U	U	U	U		C	U			U														U	U		U				U		C	U		U	U	U	U
FABRICATE MANUFACTURED PARTS/HARDWARE										U			U	U		U	U		U	U	C			U																	U							U	U
PROVIDE CUSTOMER SERVICE	U	U												U	U	C		U	U																							U				U
SCHEDULE AND TRACK CUSTOMER SERVICE													U			U	C	C					U													U	U	U	U	U
TRACK PRODUCT AND SERVICE PERFORMANCE											U	U	U	U	U	U	U	U	U	U	C																																	
MANAGE BUDGET AND ACCOUNTS	U	U	U	U	U	U	U			U		U			U			C	C	C	C					U	U										U			U	U
PROCESS PURCHASE REQUESTS	U								U		U				U							U		C	C	C	C	U	U							U
ACQUIRE AND DISPOSE RAW MATERIALS AND INVENTORY	U							U			U			U			U	U				C	C	U			U
MANAGE RAW MATERIALS AND INVENTORY								U											U		U	U	C	C	
SELL SHIP AND DELIVER INVENTORY								U	U	U		U					U	U		U	U	U	C
ACQUIRE AND DISPOSE FACILITIES	U		U		U		U											U				C		U
MANAGE AND MODIFY FACILITIES				U																			U	C
COORDINATE SECURITY	U						U														U	U		U
DETERMINE EQUIPMENT REQUIREMENTS	U	U	U	U																			U	U	C	C	U	U
ACQUIRE AND DISPOSE CAPITAL EQUIPMENT			U																			U	U	U	C			U
MANAGE EQUIPMENT		U		U				U	U									U				U	U	C
MANAGE COMPUTER SYSTEMS	U		U		U	U	U						U	U	U			U	U	U	C
ADMINISTER CONTRACT PERSONNEL	U			U	U	U	U										U						C	C
MANAGE PERSONNEL	U	U	U				U	U	U	U									U								C	C	C

C - CREATE (WHICH OFTEN IMPLIES USE)   U - USE

INFORMATION ARCHITECTURE

05/04/87

PROCESS / DATA CLASS

Data Class (column headers):
EQUIPMENT REQUIREMENTS, EQUIPMENT PLAN, EQUIPMENT DESCRIPTION, EQUIPMENT STATUS, COMPUTER SYSTEMS STATUS, FACILITY DESCRIPTION, FACILITY STATUS, CONTRACT PERSONNEL DESCRIPTION, CONTRACT ATTENDANCE RECORDS, EMPLOYEE DESCRIPTION, EMPLOYEE STATUS, EMPLOYEE ATTENDANCE RECORDS, BUSINESS PLAN, ORGANIZATIONAL UNIT DESCRIPTION, POLICIES AND PROCEDURES, CUSTOMER REQUIREMENT, BUDGET REQUIREMENTS, ACCOUNT DESCRIPTION, FINANCIAL PLAN, OPERATING PLAN, FACILITY REQUIREMENTS, FACILITY PLAN, EMPLOYEE REQUIREMENTS, JOB, PERSONNEL PLAN, INFORMATION SYSTEM PLAN, INVENTORY REQUIREMENTS, FABRICATED PART DESCRIPTION, CUSTOMER ORDER REQUIREMENTS, CUSTOMER DESCRIPTION, CUSTOMER ORDER DESCRIPTION, FABRICATED PARTS REQUIREMENT, PURCHASE REQUIREMENTS, CUSTOMER SERVICE REQUIREMENTS, PROCESS PLAN, PRODUCTION SCHEDULE, FABRICATED PART STATUS, CUSTOMER SERVICE STATUS, CUSTOMER SERVICE DESCRIPTION, MAINTENANCE SCHEDULE, FEEDBACK, PURCHASE REQUEST DESCRIPTION, VENDOR SERVICE DESCRIPTION, VENDOR DESCRIPTION, PURCHASE STATUS, INVENTORY DESCRIPTION, RAW MATERIAL DESCRIPTION, INVENTORY STATUS, RAW MATERIAL STATUS, DELIVERY STATUS, ACCOUNT STATUS, BUDGET STATUS, ACCOUNTS RECEIVABLE, ACCOUNTS PAYABLE

Process (row labels):
ACQUIRE AND DISPOSE FACILITIES
MANAGE AND MODIFY FACILITIES
COORDINATE SECURITY
PROCESS PURCHASE REQUESTS
ACQUIRE AND DISPOSE RAW MATERIALS AND INVENTORY
MANAGE RAW MATERIALS AND INVENTORY
SHIP AND DELIVER INVENTORY
ESTABLISH BUSINESS DIRECTION
COMPLY WITH POLICIES AND PROCEDURES
DETERMINE AND FORECAST CUSTOMER REQUIREMENTS
DETERMINE FORECAST AND CONTROL FINANCIAL REQUIREMENTS
DETERMINE FACILITIES AND REAL ESTATE REQUIREMENTS
DETERMINE PERSONNEL REQUIREMENTS
ESTABLISH INFORMATION SYSTEM REQUIREMENT
DETERMINE EQUIPMENT REQUIREMENTS
ACQUIRE AND DISPOSE CAPITAL EQUIPMENT
MANAGE EQUIPMENT
MANAGE COMPUTER SYSTEMS
MANAGE BUDGET AND ACCOUNTS
PROCESS CUSTOMER ORDER
DEVELOP PROCESS
SCHEDULE AND TRACK FABRICATION
FABRICATE MANUFACTURED PARTS/HARDWARE
PROVIDE CUSTOMER SERVICE
SCHEDULE AND TRACK CUSTOMER SERVICE
TRACK PRODUCT AND SERVICE PERFORMANCE
ADMINISTER CONTRACT PERSONNEL
MANAGE PERSONNEL

Blocks: FAC, MATERIAL MANAGEMENT, MANAGEMENT, EQUIPMENT, FABRICATION/CUSTOMER SERVICE, FINANCE, PERSONNEL